Blueshift - September, 2013

Finding Herschel

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Sara Mitchell: Welcome to Blueshift, brought to you from NASA's Goddard Space Flight Center. I'm Sara Mitchell.

Back in July, astronomer Nick Howes wrote a guest post for us about how he was able to image the Herschel spacecraft, even though it was a million miles away from Earth near what astronomers call the L2 point. In this podcast, we got the backstory on how he found Herschel, the equipment he used to do it, as well as a bit about his background and what drew him to astronomy.

Maggie Masetti: Thanks for joining us, Nick! How did you decide to image the Herschel spacecraft?

Nick: Well the Herschel Project was interesting. That was really a last minute thing. I worked for the European Space Agency for a couple of years working in science communication on a freelance basis for them, and I'd done a lot of stuff initially on the Herschel Telescope. For me, it was great, because it really improved my domain knowledge in infrared astronomy and what the Herschel Telescope was all about. It was a really exciting project and I got to talk to all mission managers, and principal investigators, principal scientist, etc. A really fantastic team of people, and then obviously it got switched off quite recently. The coolant ran out in April.

They put it into this kind of graveyard orbit, and I thought it would be fun maybe to get the kids to look and this. And maybe try and image it, because I know that amateurs have been imaging the Herschel Space Telescope. And obviously regularly image the Hubble, and various other telescopes, and space debris in orbit as well. And a project I've been working on now for about two-years is kind of tied into this. It's called Project Snoopy. When we're looking for some of the old Apollo hardware. Specifically the Apollo 10 Lunar Ascent Module. Which was put into heliocentric orbit in 1969, and hasn't been seen since.

So we've had people working on data for that and try to calculate all sorts of positions and stuff. That's been an exciting project, and we've now got a ephemeris which are on the minor sensors planets website from 1969-2030 for Snoopy. So it's just a case now of going through loads and loads of images and data, because right now it's just too far out for anyone to see apart from the James Webb. It's a mag 29.5 according to our calculations at the moment.

So we're doing a lot of stuff like that, and Herschel, the panic really stuck in when we looked at the JPL Horizons website. Which generates coordinates for these kind of spacecraft, and on their website it said they were going to stop generating coordinates till the end of June. And we thought, well, hold on. Their coordinates were doing one thing, and the Minor Planets Centers

coordinates were doing something else. They weren't the same. They were kind of diverging a little bit.

So we thought if this is being put a heliocentric orbit, and is going to get fainter and fainter. There's a very good chance the spacecraft may not be lost, because ESA really did have a good handle on it. But we didn't know that. We just thought if we image it, and we get a lot of data on it, Then we'll be able to get a really good orbit on it, and it turned out it was actually a little bit more important than even we thought. We originally had these three different spaces from the Minor Planet Center at JPL, and we kind of work on it in an in-between region as well.

We only had literally an hour's worth of telescope time to try and get this. So we split it into three 20-minute slots, and it was lucky the second slot is where we got it. Because then the next slot we had after that, the telescopes in Siding Spring which we were going to switch to were rained off. Because Siding Spring's a rainforest. [Laugh] Clue's in the word. So that was really quite fun, and then we did the date reduction on that. We found something pretty much where we thought it was going to be, but it was out from the Minor Planet Center coordinates, out from the JPL coordinates.

So if we hadn't of done this, who knows, it could have just drifted off into anywhere really. But in the heliocentric orbit. So we got some more time the day after. We managed to get it again. So then we're building up a bit of an orbital track on it, and then a friend at Kitt Peak, Thomas, who basically had access to the 1.3 meter telescope at Kitt Peak. He said I'm going to hunt for it as well, and he had a much wider field of view than us. And even they struggled to find it on a 1.3 meter.

Initially he was like, it's not there, it's not in the field. Anyway he then did some over reduction and he got it. At exactly where it should be, but by this point the magnitude, the kind of light level from the telescope itself would have dropped significantly. We picked it up at magnitude 18.9 which was inline with what the European Space Agency thought it would be. By the time he imaged it, it was near to mag 21. So thousands of times fainter, and this is due to the, we believe, due to the rotation of the spacecraft and some parts obviously catching the sun a lot better, and some parts really designed to kind of diffuse and not reflect the light.

So they had a go at it, and then we an email via twitter from guys on the CTIO telescope in Chile. And they said they would have a go at it, and they were using a .6 meter telescope. And they just about got it on three images that they took. And that hopefully they're going to do some follow on. So all the states is building up now to quite and interesting stack of coordinates.

Maggie: What would you think the minimum telescope requirement would be to view and object like Herschel at L2?

Nick: At L2 the James Webb is going to be essentially larger than Herschel.

Maggie: I mean are there other satellites out there too like WMAP and Planck? Are they much smaller than Herschel?

Nick: Yes. Planck is smaller than Herschel. Herschel is one of the smallest telescopes put into orbit. It's the largest single mirror telescope ever put into orbit. 3.5 m on the telescope mirror. Planck itself we could probably get with Faulkes. I would say for somebody at home. I'm working on the James Webb, tracking out to L2 shouldn't be too much of a problem. Actually at L2 you could be looking at anywhere between, depending on the reflectivity and such with magnitude 15, 16 down to maybe 18-20. So it's within reach of a good size backyard telescope.

Your guys who got their kind of 10 inch, maybe even eight inch, but definitely 10 inch and higher Schmidt-Cassegrain and Newtonian telescopes with good cold sensitive cameras should be able to pick it up in a matter of a few minutes. One of the things with Faulkes is because these objects are moving, integrating and moving objects are more complex than a static object. If you're just imaging a star, or a supernova, or a quasar, or something, you can get down to really faint magnitude just by integrating over a long period of time, but obviously anything that is moving you've got less time really to integrate on the specific target itself.

You can do stacking and tracking on the object, but I'd guess an average backyard telescope should be able to take part in the James Webb Campaign.

Maggie: In 2018 after it launches.

Nick: That's the key. That's the thing. It's a good tie in as well because obviously the European Space Agency are doing to launch. And there is a lot of European instruments on the James Webb itself.

Maggie: Yes. It's defiantly an international project.

Nick: It's fantastic. So it would be great to get international collaboration on this.

Maggie: For sure.

Nick: Tracking it out and watching it unfurl. And that's the cool thing as well, because as it's unfurling the magnitudes going to be changing. This thing's going to be getting bigger when the sunshield deploys. It's going to get bigger when the mirror deploys. So that will be a really interesting project I think in a few years to track out.

Maggie: Having tracked Herschel and image Herschel, do you think that will help you to try to do this for JWST in 2018?

Nick: Yes. It's going to be substantially easier. The problem we had with Herschel is ESA turned off the ground communications link as well.

Maggie: You weren't sure precisely where you were looking?

Nick: Exactly. We saw these coordinates diverging. With James Webb, you guys are going to be tracking it. [Laugh] The telemetry is going to be perfect. The ephemeris should be perfect. So we should have an exact position to point the telescopes at, and I would guess as soon it goes into orbit and it starts drifting out to L2. As long as it's not too close to the moon, or too close to any sun direction, it shouldn't be obviously, we should be able to just track it all the way out.

Maggie: Yeah, that would be really exciting if you could image JWST the way that you imaged Herschel. I think that would be really cool.

Nick: For kids the one thing I've noticed from the Herschel Projects, and some of the things we do are a bit funky, and a bit left field, and they're not your traditional science projects. The long-term kind of comets and stuff, but the amount of "likes" we've had on the Facebook page. The James Webb Facebook page has been astonishing, and the feedback from Facebook, and Twitter, and all the social media channels, from what we did has been really nice and really remarkable.

So it kind of shows that people are excited about this, and this is one of the reasons I've wanted to try to hunt for the Apollo hardware. Because my age and older...

Maggie: Yeah Apollo is huge. Iconic.

Nick: Yes it is, but for younger people. They may not know about it. So it was kind of a way to introduce them to some fun stuff, and also the areas we are going to be looking in. We are going to find asteroids and comets anyway. It's all good for science.

Maggie: You mentioned Apollo – was the early space program what got you interested in space and astronomy? When did that begin?

Nick: My interest in Astronomy really started probably at the age of nine, in earnest. Although my parents say to me that from the age of three I was banging on an old television when Apollo 17 was on the moon.

[Laugh]

And it's quite bizarre that the day that I was born was the day that Apollo 12, Alan Bean, was doing one of his famous moon walks. So I don't know, maybe there is some kind of history in it there, but then I remember watching Viking in the 70's and being completely enthralled by that. And my parents used to let me stay up and watch a famous TV show called the Sky at Night, which was hosted by a man called Sir Patrick Moore. Who eventually became my planetary science teacher at University, when I studied astrophysics.

So that was kind of nice, but then at the age of nine my grandmother bought me a telescope and a book on space. And that was it really. It was all I wanted to do, and all I nagged my teachers all through high school that I wanted to do was become and astronomer and astrophysicist. It's kind of weird, because the other thing I was really passionate about in my life was music. So they both... It's one of those things with astronomers that seems to be very common. You've got Brian May obviously in Queen. He's a very famous musician, and Brian Cox as well. [Laugh] So it's so weird.

Maggie: Yeah, I'm in a band as well. It is a music and astronomy thing.

Nick: It is strange. I finished high school, then I went to technical college, and then I went to University and studied astrophysics, and then after that to clear my student debts, roped into working in a music store selling synthesizer and musical instruments, and on the back of that I was offered a world tour with a pop group called Ultravox. Who were quite famous, and they played at Live Aid and some huge gigs. So I was with them for a few years.

Maggie: That's very cool.

Nick: In about 1999. My then girlfriend who is now my wife said. "Okay, what are you thinking of doing?" Because I was thinking of going back to college, and I said 'Well I want to do a Master's Degree." So I did a master's degree in acoustics and audio, and she said, "Well ,if you graduate. I'll buy you a proper telescope." So that was it, and then basically after graduation she got me a telescope. And that just rekindled the whole thing again

Maggie: That sounds really great. We recently did a blog post about you are imaging the Herschel spacecraft. So can you tell us a little bit about the telescopes you use? Because I assume it wasn't a backyard telescope to image something as far away as L2…

Nick: Around about 2009-2010, I got involved via a friend with the Faulkes telescope. And the Faulkes telescopes is a project run by the Las Cumbras Observatory Global Telescope Network. They have now basically taken over the management of these two huge telescopes and they're building a whole slew more, but originally this was set up by an English guy called Dil Faulkes around about ten years ago. He was looking at science education and ways to make it better, and he basically put down a lot his own money to build two almost Hubble size telescopes. One of which is on the top of *Haleakala* in Hawaii, right next to the Panstarrs Survey Telescope.

That's Faulkes telescope north, and Faulkes telescope south is at the Siding Springs Observatory. Which is again a great location, and we got these two two-meter telescopes which are fully robotically controlled. The idea was that it was set up for schools and education in the UK, because when it's daytime here. School hours here, it's nighttime in those two locations. So what the school kids were able to do, is they can get an account by the school. They are all going by the Internet. They can book time on these telescopes, and it's completely free of charge. That's the amazing thing about it. The kids kind of look at this and they have these

eight-million dollar telescopes, and they're going to damage them or break them. Half the time teacher's are more afraid than the kids. The kids just love it.

Maggie: I bet they do! So, last question for you, going back to Herschel - how much longer do you expect to see it? Do you think it will be observable for a while longer?

Nick: It should be for a while longer. We are estimating for a couple of months to three months. It's dropping in brightness. It's moving away, I believe, at about 200 meters per second. Into this graveyard orbit. It's going to come back in around 2027-28, and our estimates put it at about magnitude 21.7 then.

So by that point 21.7 shouldn't be that tricky. CCD cameras are getting better all the time. Telescopes are getting better. You're going to have the large synoptic sky surveys. The OWL, the overwhelmingly large telescope. James Webb will obviously be able to image all sorts of stuff down, I think John Mather said mag 32. Which is just, you would kill for that capability. There's going to be some remarkable instruments over the coming years. So we should be able to pick it back up when it comes back around, and hopefully for the next few months at least get a really good orbital track on it. So by the time it does come back we are not guessing where it is. We know exactly where it is. Nobody picks it up and thinks it's an asteroid.

Sara: That’s it for this time. Thanks to Nick for talking to us and thank to you for listening. Be sure to check out our blog at universe.nasa.gov/Blueshift for some pictures associated with this podcast, and you’ll also find all of our previous podcasts and blogs. We’re on Twitter and Facebook as NASABlueshift (that’s all one word). Tell us what you’d like to hear about there, or through our website feedback form! I’m Sara Mitchell, bringing the Universe closer to you with Blueshift.

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